

What is claimed is:

1. A method for manufacturing a reticle blank usable for fabricating a segmented reticle for use in charged-particle-beam microlithography, the method comprising:

5 preparing a reticle substrate comprising a silicon substrate, the reticle substrate having first and second major surfaces;

beginning on the second major surface, discharge-machining part way into a thickness dimension of the silicon substrate toward the first major surface so as to form from the silicon substrate a grillage of intersecting struts separating respective subfield regions from one another; and

10 in regions not occupied by respective struts, dry-etching further into the thickness dimension of the silicon substrate toward the first major surface until each subfield region includes a respective membrane formed by a residual portion of the reticle substrate extending into the thickness dimension from the first major surface.

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2. The method of claim 1, wherein the discharge-machining step is performed using a discharge-machining electrode placed, at initiation of discharge-machining, adjacent the second major surface and separated therefrom by a discharge gap.

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3. The method of claim 2, wherein:

the discharge-machining electrode comprises a facing surface in which are defined grooves that correspond in respective dimensions, positions, and arrangement to desired respective dimensions, positions, and arrangement of the struts; and

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between the grooves are projections that correspond in respective dimensions, positions, and arrangement to desired respective dimensions, positions, and arrangement of the subfield regions.

5 4. The method of claim 3, wherein:

the reticle blank is formed to have a pattern-defining zone having an area;
and

the discharge-machining electrode has an area that is smaller, by an integer ratio, than the pattern-defining zone.

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5. The method of claim 3, wherein each groove has a width equal to two times the discharge gap, plus a desired width of the corresponding strut to be formed by the groove.

15 6. The method of claim 1, wherein the step of preparing a reticle substrate comprises preparing a silicon-on-insulator (SOI) wafer substrate, comprising a silicon oxide layer and a silicon layer on the first major surface.

20 7. The method of claim 6, wherein the silicon oxide layer is formulated to be an etch-stop layer.

8. The method of claim 6, wherein dry-etching is continued through the thickness dimension to the etch-stop layer.

25 9. The method of claim 6, wherein the step of preparing a reticle substrate comprises forming a metal layer on the second major surface.

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10. The method of claim 9, wherein the discharge-machining step is performed using a discharge-machining electrode placed adjacent the metal layer and separated therefrom by a discharge gap.

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11. The method of claim 10, wherein:

the discharge-machining electrode having a facing surface in which are defined grooves that correspond in respective dimensions, positions, and arrangement to desired respective dimensions, positions, and arrangement of the struts; and

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between the grooves are projections that correspond in respective dimensions, positions, and arrangement to desired respective dimensions, positions, and arrangement of the subfield regions.

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12. The method of claim 9, wherein dry-etching is performed using remaining portions of the metal layer as an etching mask.

13. A reticle blank manufactured by a method as recited in claim 1.

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14. A method for fabricating a segmented reticle for use in charged-particle-beam microlithography, comprising:

fabricating a reticle blank using a method as recited in claim 1;

forming a layer of resist on the first major surface of the reticle blank, the layer of resist being patterned according to a desired reticle pattern; and

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using the patterned resist as a mask, forming elements of the pattern on the reticle blank.

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15. A reticle fabricated by a method as recited in claim 14.

16. A method for manufacturing a reticle blank usable for fabricating a
5 segmented reticle for use in charged-particle-beam microlithography, the method
comprising:

preparing a reticle substrate from an SOI wafer comprising a relatively thick
silicon substrate layer having first and second major surfaces, the silicon substrate
having a thickness dimension and including a relatively thin silicon oxide layer on
10 the first major surface and a relatively thin silicon layer superposed on the silicon
oxide layer, and a relatively thin metal layer on the second major surface;

beginning at the metal layer on the second major surface, discharge-
machining into the silicon substrate toward the first major surface through most of
the thickness dimension so as to form from the silicon substrate a grillage of
15 intersecting struts separating respective subfield regions from one another;

in regions not occupied by respective struts, dry-etching further through the
thickness dimension of the silicon substrate to the silicon oxide layer, serving as an
etch-stop layer, so as to provide each subfield region with a respective membrane
formed by the silicon oxide layer and relatively thin silicon layer; and

20 removing exposed portions of the silicon oxide layer.

17. The method of claim 16, wherein the discharge-machining step is
performed using a discharge-machining electrode placed, at initiation of discharge-
machining, adjacent the metal layer and separated therefrom by a discharge gap.

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18. The method of claim 17, wherein:

the discharge-machining electrode comprises a facing surface in which are defined grooves that correspond in respective dimensions, positions, and arrangement to desired respective dimensions, positions, and arrangement of the struts; and

- 5 between the grooves are projections that correspond in respective dimensions, positions, and arrangement to desired respective dimensions, positions, and arrangement of the subfield regions.

- 10 19. The method of claim 17, wherein dry-etching is performed using remaining portions of the metal layer as an etching mask.

20. A reticle blank manufactured by a method as recited in claim 16.

- 15 21. A method for fabricating a segmented reticle for use in charged-particle-beam microlithography, comprising:

 fabricating a reticle blank using a method as recited in claim 16;

 forming a layer of resist on the first major surface of the reticle blank, the layer of resist being patterned according to a desired reticle pattern; and

- 20 using the patterned resist as a mask, forming elements of the pattern on the reticle blank.

22. A reticle fabricated by a method as recited in claim 21.

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